Swami Ramanand Teerth Marathwada University, Nanded, Maharashtra, India

(UGC recognised, NAAC Re-accredited 'B++' grade state university)

"STUDIES ON GREEN SYNTHETIC METHODOLOGIES OF HETEROCYCLIC COMPOUNDS AND THEIR BIOLOGICAL ACTIVITIES"

Research Proposal submitted
In partial fulfilment of registration to
Ph.D. Programme
In the subject
Chemistry faculty of Science and Technology

Submitted by

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Ph.D. Synopsis / Work plan

"STUDIES ON GREEN SYNTHETIC METHODOLOGIES OF HETEROCYCLIC COMPOUNDS AND THEIR BIOLOGICAL ACTIVITIES"

1. INTRODUCTION

Heterocyclic compounds are of very much interest in our daily life·Heterocyclic compounds have one or more hetero atoms in their structure. They may be cyclic or non cyclic in nature. The presence of the heteroatoms gives heterocyclic compounds physical and chemical properties that are often quite distinct from those of their all-carbon-ring analogs. Heterocyclic compounds have a wide range of application. Heterocyclic chemistry has its origin in organic synthesis, natural products chemistry, and medicinal chemistry.

They are used as vehicles in the synthesis of other organic compunds. heterocyclic compounds and their structures can be subtly manipulated to achieve a required modification in function.They are predominantly used as pharmaceuticals, as agrochemicals and as veterinary products. They also find applications as sanitizers, developers, antioxidants, as corrosion inhibitors, as copolymers, dye stuff.

Heterocyclic compounds are immensely important for human life and plays very important role in biological aspect of life. Some of the natural products e.g. antibiotics such as penicillin's, cephalosporin; alkaloids such as vinblastine, morphine, reserpine etc. have heterocyclic moiety. heterocyclic compund is found as a key component in biological processes.Biological molecules such as DNA and RNA, Amino acids ,chlorophyll, hemoglobin, vitamins and many more contains the heterocyclic ring in major skeleton.

2. Purpose of proposed Research work

We focused on the basic principals and fundamental reactions of heterocyclic synthesis, and most of these reactions refer to the homogeneous solution phase. However, it is now standard practice to conduct many synthetic operations. This is particularly important for creating large "libraries" of compounds. These great advantage of solid-supported reactions is in the manipulationand purification of product. Many of the reactions that we have seen, both

functional group transformations and heterocyclic ring construction, with a wide range of reagents, and the list is growing rapidly.

The proposed research work deal with the synthesis of heterocyclic compounds by new efficient methodology and assessment of biological activities of these synthesized heterocycles. Hence the present work entitled " Studies on green synthetic methodologies of Heterocyclic compounds and Their biological properties"is divided into two sections.

Section A: Synthesis of Heterocyclic compounds by using green methodology, and spectroscopic characterization.

Section B: Biological Study of Synthesized heterocyclic Compounds.

3. Review of Literature

After literature survey to the best of our knowledge showed that synthetic Heterocyclic chemistry is vastly expanding, because of the enormous amount of research work is being done in this area.synthetic Heterocyclic chemistry is one of the most growing and interesting, applied branches of organic chemistry and of greatest practical and biological importance.In this field it provides several advantages such as simple work up procedure environmentally benign, neutral conditions and high yield.

A. Mermer et al.[(1)] has given a brief review about Recent studies of nitrogen containing heterocyclic compounds as novel antiviral agents. S. Pathania et al[(2)] *has studied an update on* Role of sulphur-heterocycles in medicinal chemistry. Omid Marvi et al[(3)] used Citrus Juice: Green and Natural Catalyst for the Solvent-free Silica Supported Synthesis of *β*-Enaminones using Grindstone Technique. Gopinath S. Khansole et al[(4)] studied Facile Synthesis of Some New Pyrimido[2,3-d]-1,3,4-Thiadiazoles with their Biological Potential . Abbas A. et al[(5)] given a review of Biological Importance Of Heterocyclic Compounds. Fathy M. A.et al[(6)] investigated a Facile Synthesis and Drug Design of Some New Heterocyclic Compounds Incorporating Pyridine Moiety and Their Antimicrobial Evaluation**.** A. Ambhore et al[(7)] given an Efficient One-pot Synthesis of some New Pyrazolyl Appended 1,3,4-Oxadiazole Derivatives as Antibacterial and Antioxidant agents. Farhad S.et al[(8)] used P4VPy–CuO nanoparticles as a new, efficient and heterogeneous polymeric catalyst for clean synthesis of bis(indolyl)methane and biscoumarin derivatives . S.-X. Liuet al [(9)] studied oxa-Michael-Henry reaction of salicylaldehyde derivatives with β-nitrostyrenes is catalyzed by potassium carbonate using solvent-free ball milling. Seyed

M.B. et al, [10] have synthesized coumarins via pechmann reaction in water using magnetically recoverable and reusable catalyst. Henry A.et al , [11]studied Apple and witting reaction in new way. Ran Ma et al[12] studied Reduction of sulfoxides and pyridine-N-oxides over iron powder with water as hydrogen source using carbon dioxide.Arora P. et al., (13) summarized Importance Of Heterocyclic Chemistry. Bo J.et al, [14] Studied Multicomponent Reactions for the Synthesis of Heterocycles.Biswanath D.et al[15] studied Application of heterogeneous catalysts for an efficient synthesisof keto enol ethers.

4. Research Gaps

Though there has been enormous research in the area of heterocyclic chemistry yet recently, in day to day life the scientist communities are trying to synthesize novel bioactive compounds which are beneficial to society, By using green methodology.

5. IMPORTANCE OF THE STUDY

a) International

Study of synthesis of heterocyclic compound with new methodologies is hot area of research and many groups of scientists are working in this area of the research. Few of the research groups working at international level in this area of research are listed below:

1. Yoshinori Yamamoto Department of Chemistry, Graduate School of Science, Tohoku University, Sendai 980-8578, Japan.
2. Mohmud Sherif Department of Chemistry, Faculty of Science, Cairo University, Giza12613, Egypt.
3. Tienan Jin, WPI-AIMR, Tohku University, Katahira2-1-1, Aobaku, Sendai 980-8577, Japan.
4. Dr.J.S.Yadav,Dr.P.S.Kalsi and Dr.Y.R.Sharma,Jagdmba Singh et al.
5. Dr. B.P.Bandga and his research group, EX-vice chancellor of solapur University, solapur.

b) National

Many groups of researchers in India are working on the study of heterocyclic compounds. The synthesis, characterization and biological significance of heterocyclic compounds containing

nitrogen, oxygen and sulfur as a heteroatom have been carried out by following groups of researchers:

1. 1. Dr. A. T. Bigu Organic Chemistry Division, National Chemical Laboratory, Pune, India

2. Dr. N. T. Patil Organic Chemistry Division II, Indian Institute of Chemical Technology, Hyderabad-500 007, India

3. Dr. D. S. Reddy Organic Chemistry Division, IICT, Hyderabad, India.

4. Dr. P. P. Wadgaonkar, Scientist National Chemical Laboratory, Pune

5.Dr.S.V.Bhosle,Sr.Scientist,Polymer and Functional Material Division,CSIR-IICT,Hyderabad,Telangana,India.

c) Regional

Some eminent research groups works in the same field of heterocyclic chemistry are avaible in our own region .they are listed as below:

1. Dr. Bhaskar Sadashiv Dawane EX-Professor,School of Chemical Sciences, Swami RamanandTeerthMarathwada University, Nanded-431606 (MS) India

2. Dr.S.P.Vartale Associate Professor P.G.Research Center Dept. of Chemistry Yeshwant Mahavidyalaya, Nanded

d) Scope of Study

As the applications of heterocyclic compounds are widespread and well known, it is an evergreen and growing branch of chemistry. It is related to every aspect of human lives .the scope of the study is to underastand heterocyclic compounds in various ways for the betterment in the field of pharmaceuticals,biomedical, Agriculture, Dye industries , Medical and many more. Heterocyclic compounds one of the important sorts of organic compounds, which is taking a wide range in the medicinal chemistry this is due to the huge number of heterocyclic compounds that used in medicine as drugs for varied diseases. The drugs which contain the core of heterocycle or its skeletons has Antifungal activity, anti-inflammation, anti-bacterial, antioxidants, anticonvulsant, antiallergic, herbicidal activity and anticancer, anti-viral .

6. Objectives of Research

1. To study the various techniques, green synthetic routes for the preparation a of heterocyclic compounds.
2.Design synthesis of supported/green catalytic reagents.
3. Extending the research of novel catalytic reagents to new domains, especially targeting the synthesis of different novel heterocyclic derivatives.
4. Studying mechanistic details and pathways of novel catalytic reagents.
5.To study the newly synthesized compounds with help of spectral data and its biological activity.

7. Hypothesis

The constant study and growth in heterocyclic compound and its derivative is due to its significant biological activity and also with the fact that they enable the development of novel materials of unique properties. Heterocyclic compounds are promising and interesting due to its medicinal properties and use in pesticide, insecticide and also find important application in biochemical process. These compound and its derivatives find application in the medicinal and agricultural field so its synthesis by new method and technique proved to be useful in industry and micro-scale study in chemistry labs. Such compounds received a significant attention for their preparation over a long period due to its industrial applications and biological properties as mentaion above.

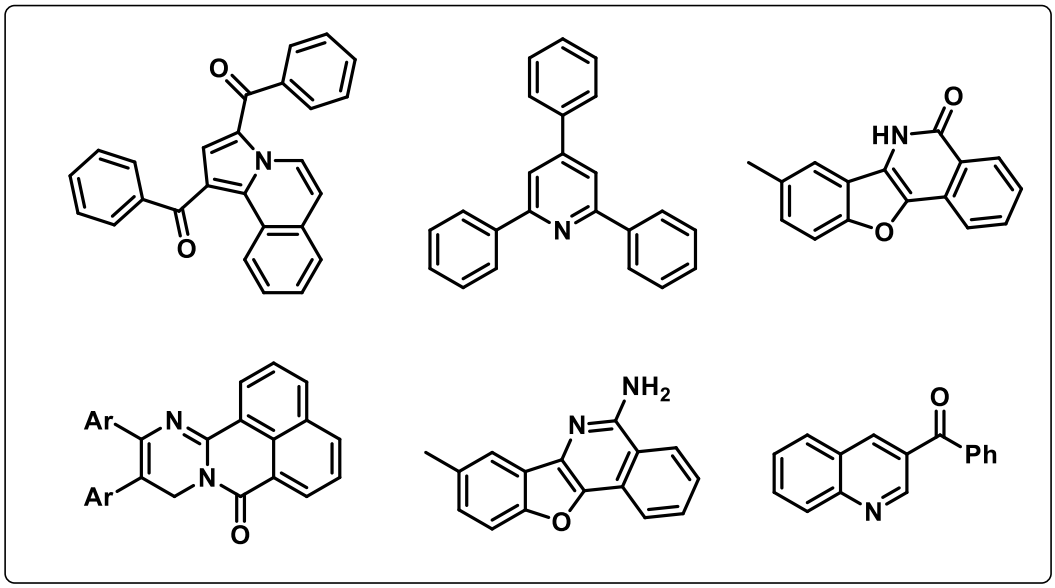
8. Methodology

Present proposal is concerning with new methodologies, processes involving solvent free reaction or the reaction in aqueous solvent accompanied with many advantages. A powerful tool is the generation of structurally diverse molecule due to their special selectivity, ease of set-up and work-up comprising great interest. One of the promising advantage of solvent free reaction,reaction in aqueous solvent or use of cheaper less toxic solvent reduces cost of reaction, required time, more environment benign ,no special equipment is needed should become a decisive factor in industry. The dive for the development of dry media reaction in chemistry is

economic, easy ease of purification, high reaction rate, environmental friendly because it reduces pollution and bring down handling cost due to simple synthetic procedure, work up technique and saving labor work.

These would be significant aspect as per factory manufacturing concern. use of certain solvents suffers certain drawbacks such as longer reaction time, poor yield, expensive and reaction condition and the use of large quantity of organic solvent .thus there is a probability that reaction under solvent free condition, aqueous or some green solvent may save money, time and also environment.

Our methodology will focus on developing a convienent solvent free synthesis procedure using suitable supported /green catalyst under mild reaction conditions with easier work up, getting high yield of products and reduce time required.



9. Limitations of work

Heterocyclic compounds can be highly complex and developing green synthetic routes for them can be challenging. Achieving high yields and purity while maintaining green principles may be difficult in some cases.

10. Expected Outcome

We expect to develop synthetic procedure for preparation of heterocyclic compounds with high yields,operational simplicity,clean reaction conditions and minimum pollution measures environmentally benin conditions.short reacrion time. The present study will be very much helpful for the researchers working in the field of the heterocycles, medicinal chemistry and pharmaceutical sciences. The biological properties of synthesized heterocycles that will be assessed in the proposed work will definitely contribute to the science fraternity. The knowledge of new green synthetic pathways is very important in many practical problems, concerning environmental issues regarding traditional synthetic method. This area of research has applications in the fields like dyes, photosensitizers, coordination compounds, polymeric materials, and many other fields.

11. Yearwise Plan of Work

Proposed work Plan/ Formulation and Structure of Study:

- **Year-wise Plan of work and targets to be achieved**

First year	Extensive collection of references, along with literature survey, Designing of methods for the synthesis of heterocyclic compounds. Study of various supported/green catalysts for the synthesis of heterocyclic compounds containing Oxygen, sulfur and nitrogen.
Second year	Synthesis of various heterocyclic compounds, purification and assessment of structure of newly synthesized compound using spectral characterization techniques and Study on biological aspect of synthesized compounds.
Third year	Interpretations of new synthetic routes of preparation of studied heterocycles, conclusions etc. Communication of results obtained in different s chemes to the journals for publication.

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